

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

### WRITTEN OPINION

(PCT Rule 66)

To: TODD S. PARKHURST  
GARDNER, CARTON & DOUGLAS  
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CHICAGO, IL 60610

Date of Mailing  
(day/month/year)

29 MAY 1997

Applicant's or agent's file reference

P1098PCT

REPLY DUE

within TWO months  
from the above date of mailing

International application No.

PCT/US96/06561

International filing date (day/month/year)

09 MAY 1996

Priority date (day/month/year)

31 MAY 1995

International Patent Classification (IPC) or both national classification and IPC  
Please See Supplemental Sheet.

Applicant

THE BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

**When?** See the time limit indicated above. ~~The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).~~

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed,** the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 30 SEPTEMBER 1997.

Name and mailing address of the IPEA/US  
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## PCT/US96/06561

WRITTEN OPINION

International application No.

PCT/US96/06561

**VI. Certain documents cited**

**1. Certain published documents (Rule 70.10)**

<u>Application No. Patent No.</u>	<u>Publication Date (day/month/year)</u>	<u>Filing Date (day/month/year)</u>	<u>Priority date (valid claim) (day/month/year)</u>
US, A, 5,487,917	30 JANUARY 1996	16 MARCH 1995	

**2. Non-written disclosures (Rule 70.9)**

<u>Kind of non-written disclosure</u>	<u>Date of non-written disclosure (day/month/year)</u>	<u>Date of written disclosure referring to non-written disclosure (day/month/year)</u>

WRITTEN OPINION

International application No.

PCT/US96/06561

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. STATEMENT**

Novelty (N)	Claims	<u>3,5-9,11-17,20-21</u>	YES
	Claims	<u>1,2,4,10,18 and 19</u>	NO
Inventive Step (IS)	Claims	<u>NONE</u>	YES
	Claims	<u>1-21</u>	NO
Industrial Applicability (IA)	Claims	<u>1-21</u>	YES
	Claims	<u>NONE</u>	NO

**2. CITATIONS AND EXPLANATIONS**

Claims 3,5-9,11-17,20-21 meet the criteria set out in PCT Article 33(2), because no single reference teaches or fairly suggests exposing a resin coated fiber to an etchant to carbonize and activate the resin.  
Claims 1,2,4,10,18 and 19 lack novelty under PCT Article 33(2) as being anticipated by Feldman et al.(5,376,407).

Feldman teaches a process of coating carbon yarn by passing it through a reservoir of molten pitch of low enough viscosity to thoroughly permeate the yarn. The yarn is then pre-pyrolyzed in an argon atmosphere, which inherently meets the limitations of exposing the coated fiber to an etchant and also meeting the inert gas etchant of claim 2.

Claims 5,6,8,9,11-13,17 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Feldman et al. in view of Bookbinder et al. and further in view of Bose et al.

Feldman is applied above but lacks the etchants of claim 3, the phenolic resins of claim 5, the substrates of claims 6-8, the crosslinking agent of claims 9,13 and 17, and the spray coating of claim 11, the vacuum impregnation of claim 12.

Bose discloses a process of making a fuel cell electrode wherein a fibrous carbon precursor web is formed, dried, and then saturated with a resinous binder which will carbonize when heated, thus meeting the substrates of claims 1 and 8. The saturated web is then dried and heat treated to convert the binder to a glassy carbon. In Ex.1 the fibrous substrate is a porous PTFE coated fiberglass cloth, meeting claim 6, and the powdered phenolic resin is applied by showering it onto the substrate, meeting claim 11, and is further drawn through the cloth by a vacuum, thus also meeting claim 12. In Example 2, the phenolic resin is dispersed in a water carrier and in Ex.3 it is dissolved in an organic solvent. In col.3, lines 37-62, Bose discusses adding metallic catalyst after the heat treatment, but lacks adding catalytic metals to the resin itself.

Bookbinder teaches crosslinking agents which meet the (Continued on Supplemental Sheet.)

WRITTEN OPINION

International application No.

PCT/US96/06561

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 1,4,14,15,17,18 are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because the claims indefinite for the following reason(s): Claim 1, line 5, lacks antecedent basis for "the etchant" and further appears to require the resin be activated after carbonization, which is confusing. In claims 4 and 18, "low" viscosity is indefinite, being subjective. Claim 15 lacks antecedent basis for "the degradation temperature" and claim 17 lacks antecedent basis for the cross-linking agent. It is also noted that there are two claim 5's. The second claim 5 and all subsequent claims have been renumbered to correct this.

## WRITTEN OPINION

International application No.

PCT/US96/06561

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

**TIME LIMIT:**

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

**CLASSIFICATION:**

The International Patent Classification (IPC) and/or the National classification are as listed below:  
IPC(6): B05D 3/02, 3/00, 3/04, 3/10; B01J 20/26 and US Cl.: 427/228, 244, 294, 341, 377, 381, 389.7, 389.8; 502/402

**V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):**

limitation of claims 9,13 and 17 as useful with phenolic resins and discloses various phenolic resins known in the art in cols.3 and 4. It would have been obvious to a routineer in the art to have modified the process of Feldman by substituting the phenolic resins of Bose and Bookbinder *et al.* for the molten pitch in the process of Feldman, because both pitch and phenolic resins are old and well known in the carbonizing art and would be expected to produce useful carbonized articles.

Claims 3 and 14-16,20-21 lack an inventive step under PCT Article 33(3) as being obvious over Feldman *et al.* in view of Marek *et al.*

Feldman lacks the etchants of claim 3 and the phenolic resins of claim 5. Marek teaches a reticulated polyurethane foam treated with a solution of a phenolic resin and pitch in a tetrahydrofuran solvent. The coated structure is heat-treated through a curing cycle and through a carbonizing cycle to obtain a low density carbon foam which may be activated by selective oxidation of the carbon article. Disclosed oxidizing agents include oxygen and carbon dioxide, which may be generated by the inclusion of fine calcium carbonate which releases carbon dioxide upon heating, thus meeting claims 3 and 14. The reference also teaches activation by addition of metal chlorides, such as zinc chloride, meeting the limitation of instant claim 16 of catalytic metals added to the resin. The reference inherently appears to meet claim 15 as the phenolic resin and the pitch are unlikely to have identical degradation temperatures. Specific phenolic resins are not disclosed. It would have been obvious to a routineer in the art to have modified the process of Feldman by using less expensive etchants, as taught by Marek, because of the expectation of similarly activating the coated substrate.

Claim 7 lacks an inventive step under PCT Article 33(3) as being obvious over Feldman *et al.* in view of Ledru. The reference lacks the limitation of a woven substrate. Ledru teaches coating fibrous substrates, including woven layers, which are impregnated with a carbon-containing material, preferably a resin, such as a thermo-setting phenol-formaldehyde resin which is polymerized by addition of a catalyst system, the catalyst preferably being able to withstand pyrolysis temperatures. It would have been obvious to a routineer in the art to have modified the process of Feldman by similarly coating a woven porous substrate, as taught by Ledru, because of the expectation of successfully producing an activated carbonized cloth.

Claims 15 and 21 lack an inventive step under PCT Article 33(3) as being obvious over Feldman *et al.* in view of Wallouch.

The reference lacks the limitation of claim 15. Wallouch teaches a method of increasing the density and strength of carbonaceous products by coating the pitch impregnated article to an additional coat of thermosetting polymer, which is partly cured to provide an encasing shell of polymer. Then the pitch impregnated body is subjected to carbonization by rebaking so that during carbonization the shell is mechanically stable to temperature above the softening and flowing temperatures of the pitch. The shell is then decomposed and carbonized as higher temperatures are reached, but during initial stages it acts to retain the impregnant within the substrate, thus resulting in "larger quantities of coked impregnant remaining in the body with higher apparent density and strength in the resultant product. Wallouch discloses a preferred coating composition as comprising pitch, a resinifiable furan solvent, a catalytic curing agent and a solid resin such as a phenolic or epoxy resin. The teaching of Wallouch renders the limitation of claim 15 obvious because of the expectation of increased coke yield, density and strength of the carbonized product.

WRITTEN OPINION

International application No.

PCT/US96/06561

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 11

Claims 1-21 meet the criteria set out in PCT Article 33(4), the products of the process being useful in filtration or adsorption, for example.

US 5,376,407 A (FELDMAN et al.) 27 DECEMBER 1994, see col.1, line 13-col.2, line 14.

US 5,389,325 A (BOOKBINDER et al.) 14 FEBRUARY 1995, see col.1, line 5-col.7, line 18; examples.

US 5,026,402 A (BOSE et al.) 25 JUNE 1991, see entire disclosure.

US 4,321,154 A (LEDRU) 23 MARCH 1982, see entire disclosure.

US 3,922,334 A (MAREK et al.) 25 NOVEMBER 1975, see entire disclosure.

US 5,277,802 A (GOODWIN) 11 JANUARY 1994, see abstract; col.1, line 41-col.3, line 22; col.6, line 13-col.8, line 2.

US 4,100,314 A (WALLOUCH) 11 JULY 1978, see col.1, line 20-col.3, line 8; Examples.